

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

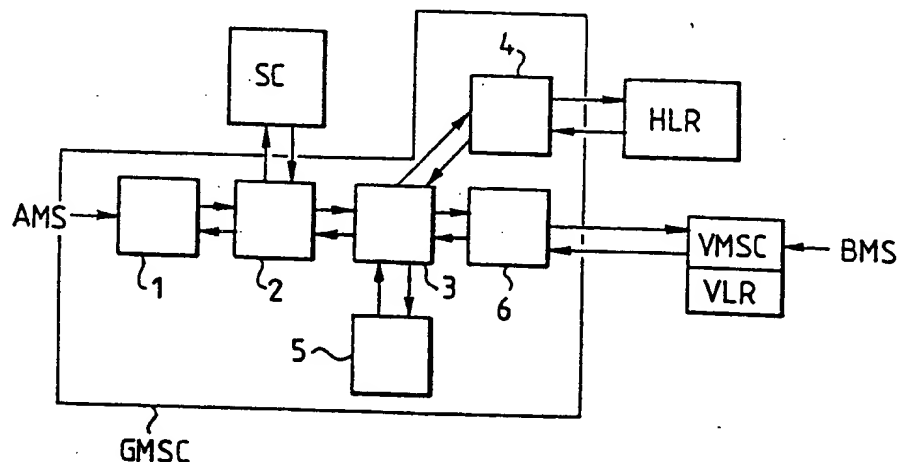


FQ + OAH

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : H04Q 7/04		A1	(11) International Publication Number: WO 93/26131
			(43) International Publication Date: 23 December 1993 (23.12.93)
(21) International Application Number: PCT/FI93/00235		(81) Designated States: AU, GB, JP, NO, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date: 1 June 1993 (01.06.93)			
(30) Priority data: 922751 12 June 1992 (12.06.92) FI		Published With international search report.	
(71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Mäkkylän puistotie 1, FIN-02600 Espoo (FI).			
(72) Inventor; and			
(75) Inventor/Applicant (for US only): KOIVUNEN, Seppo [FI/FI]; Vaiveronkatu 17 B 17, FIN-05900 Hyvinkää (FI).			
(74) Agent: OY KOLSTER AB; Stora Robertsgatan 23, P.O. Box 148, FIN-00121 Helsinki (FI).			

(54) Title: METHOD AND ARRANGEMENT FOR PROCESSING SHORT MESSAGES IN A CELLULAR NETWORK



(57) Abstract

A method and arrangement for processing short messages in a mobile services switching centre (GMSC) of a cellular radio network. The method comprises the following steps: an A-subscriber (AMS) sends a short message provided with the routing address of a B-subscriber (BMS); the routing address contained in the short message is checked in the mobile services switching centre (GMSC); and when the routing address is that of the B-subscriber (BMS), the mobile services switching centre (GMSC) requests the routing information of the B-subscriber (BMS) from the home location register (HLR); if the B-subscriber can be reached, the home location register (HLR) sends the routing information to the requesting mobile services switching centre (GMSC); and the mobile services switching centre (GMSC) routes the short message to the B-subscriber (BMS) on the basis of the routing information received.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NL	Netherlands
BE	Belgium	GN	Guinea	NO	Norway
BF	Burkina Faso	GR	Greece	NZ	New Zealand
BG	Bulgaria	HU	Hungary	PL	Poland
BJ	Benin	IE	Ireland	PT	Portugal
BR	Brazil	IT	Italy	RO	Romania
CA	Canada	JP	Japan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SK	Slovak Republic
CI	Côte d'Ivoire	LI	Liechtenstein	SN	Senegal
CM	Cameroon	LK	Sri Lanka	SU	Soviet Union
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	MC	Monaco	TG	Togo
DE	Germany	MG	Madagascar	UA	Ukraine
DK	Denmark	ML	Mali	US	United States of America
ES	Spain	MN	Mongolia	VN	Viet Nam
FI	Finland				

Method and arrangement for processing short messages in
a cellular network

5 The invention relates to a method and arrange-
ment for processing short messages in a mobile services
switching centre of a cellular network.

10 The invention operates in a cellular network
that contains a mobile services switching centre. The
network comprises a home location register for permanent
storing of location and subscriber data on radio tele-
phones registered in the network. The geographical area
covered by the network is divided into smaller mobile
services switching centre areas (MSC area), each of
which comprises a visitor location register for tempor-
15 ary storing of subscriber data on radio telephones
visiting the MSC area and a mobile services switching
centre interconnected with the visitor location regis-
ter. Each MSC area is further divided into location
areas, which are divided into cells. Each cell comprises
20 at least one base transceiver station that is capable
of establishing a radio link with the active radio tele-
phones located in the cell.

25 In different cellular radio systems or radio
telephone systems currently used or planned, the geo-
graphical area covered by the system is divided into
separate smaller radio areas or cells in such a way that
when a radio telephone or mobile phone is in the cell,
it communicates with a fixed network via a base trans-
ceiver station located in the cell. The mobile phones
30 of the system may freely roam from one cell to another
within the system. One of these systems is the digital
mobile phone system GSM (Global System for Mobiles).

35 In cellular radio networks it is known to trans-
mit short messages to a short message service centre
that is separate from a cellular radio network. Recom-

5 mendation GSM 03.40, ETSI/PT, February 1992 includes a
description of such a system transmitting short
messages. It describes interconnection of a short
message service centre with a mobile services switching
10 centre of a cellular radio network and operation of this
short message service centre as it transmits short
messages from outside the cellular radio network and
from one subscriber (A-subscriber) of the cellular radio
network to another subscriber (B-subscriber) of the
15 network, or to a communicating means outside the network
capable of receiving and/or transmitting short messages.
Recommendation GSM 04.11, ETSI/PT 12, February 1992
provides a closer description of transmission of short
messages on a radio path between GSM terminal equipment,
20 a mobile services switching centre and a short message
service centre.

 The above prior art solutions and their
practical applications have focused on communication by
means of short messages between the subscribers of a
25 cellular radio system and the communicating means
outside the system capable of receiving and/or trans-
mitting short messages. Known solutions of this kind
have thus granted that a separate short message service
centre which requires space and financial resources,
30 must be connected to the system, although the centre
requires new arrangements separate from those required
by a cellular radio network to control it and render it
compatible with the network.

 The object of the present invention is to
35 simplify transmission of short messages from an A-
subscriber of a cellular radio system to a B-subscriber
in a fast and inexpensive manner and without additional
equipment.

 According to the invention this new kind of
method for processing short messages in a cellular radio

network is characterised by the following steps: an A-subscriber sends a short message provided with the routing address of a B-subscriber; the routing address contained in the short message is checked in the mobile services switching centre; and when the address is that of the B-subscriber, the short message is stored A-subscriber-specifically in the short message storing means of the mobile services switching centre, the mobile services switching centre requests the routing information of the B-subscriber from the home location register, and if the B-subscriber can be reached, the home location register sends the routing information to the requesting mobile services switching centre, and the mobile services switching centre routes the short message to the B-subscriber on the basis of the routing information received.

The new kind of arrangement according to the invention for processing short messages in a cellular radio network is characterised by comprising an address processing means for checking the address contained in the short message; a storing means for storing the short message in a mobile services switching centre; a communicating means communicating with a home location register HLR and requesting routing information from the HLR; a short message transmitting means for transmitting short messages from a mobile services switching centre to a B-subscriber; a means for controlling transmission of short messages to instruct the storing means to store short messages, to instruct the communicating means to request the routing information of the B-subscriber from the HLR, to forward the routing information of the B-subscriber received from the HLR from the communicating means, and to transmit the short message from the storing means to the short message transmitting means in response to the short message sent by the A-

subscriber and provided with the address of the B-subscriber, and to send an acknowledgement to the A-subscriber.

5 The basic idea of the invention is that all the measures needed for transmission of short messages are taken in a mobile services switching centre. This allows fast and inexpensive transmission of short messages from an A-subscriber of a cellular radio network to a B-subscriber.

10 The advantage of this kind of method and arrangement for processing short messages in a cellular radio network is that no separate short message service centre SC is needed for transmission of short messages from an A-subscriber of a cellular radio network to a
15 B-subscriber. A separate SC is expensive and inconvenient since it requires its own control system and an interconnection as defined in GSM 03.40 with a mobile services switching centre. A separate SC also requires separate maintenance and space on the premises of a
20 teleoperator. Particularly in telecommunication networks where there is no need to transmit short messages between a mobile phone system and other message transmitting services, a separate SC is not needed but transmission of short messages in a mobile phone network
25 can be carried out in accordance with the present invention.

 In addition, the prior art arrangement for transmitting short messages has not allowed the B-subscriber to send an acknowledgement to the A-subscriber to show that it has received the short
30 message transmitted. The system of the invention, however, offers a multiple choice of functions of acknowledgement. For example, in the system of the invention it is possible to send an acknowledgement to
35 the A-subscriber to show whether the B-subscriber has

received the short message or whether the short message is e.g. temporarily stored for re-transmission. The acknowledgement may be a conventional acknowledgement according to GSM 03.40, or a short message.

5 In the following the invention is described in greater detail with reference to the attached drawings, wherein

Fig. 1 shows a schematic view of a cellular radio system to which the method and system according
10 to the invention can be applied,

Fig. 2 shows the transmitting parts of a mobile services switching centre according to the invention that is capable of independently transmitting short messages,

15 Fig. 3 shows the frame structure of a short message according to the invention,

Fig. 4 shows a message waiting data list according to the invention in the HLR.

20 In the following the method of the invention will be described in the GSM, which is in fact where the invention is primarily applied. However, the method of the invention can be applied to other similar radio systems or modifications of the GSM. The basic structure and functions of the GSM are well known to those skilled
25 in the art and they are defined relatively accurately in the specifications of the GSM, particularly in GSM recommendations 01.02, 11.30, 11.31, 11.32 and 03.40. Some of the basic concepts of the GSM and elements relevant to the invention are defined below, with
30 reference to Fig. 1. An area in which GSM services are available is called a GSM network (GSM service area) and it may cover several countries. A GSM network may divide into national GSM networks (PLMN service area), each of which is an area covered by one operator providing GSM
35 services. Several GSM networks may exist in one country,

and the geographical areas covered by them may overlap. In the following the term "mobile phone system" refers primarily to such a national mobile phone system, and the system may be connected to other national mobile phone systems or other communication systems, such as a public telephone network.

5 A national GSM network may comprise one or more MSC areas, which are areas in which services are provided by one mobile services switching centre. An MSC
10 area of the GSM may in turn divide into one or more location areas, which are areas covered by a plurality of cells. A cell is the smallest geographical area in the system. It comprises one or more base transceiver stations and employs defined communication channels.

15 A national GSM network generally comprises one home location register HLR, which is a database in which the data of a mobile phone, e.g. location data, are permanently stored. The system further comprises several visitor location registers VLR, one or more per each MSC
20 area. A VLR is a database in which the data of a mobile phone are stored when the mobile phone is visiting the area of the VLR. A VLR can locate a mobile phone MS with an accuracy of one location area. An HLR on the other hand has information indicating the VLR the area of
25 which the MS is visiting, and it gives the routing information for the calls to the MS to the telephone network. The HLR receives the necessary routing information from the VLR. The HLR and VLR have only a signalling connection with the other components of the
30 mobile phone network.

For purposes of simplicity, the method of the invention is described as applied to the system of Fig. 1, in which each MSC area has its own VLR interconnected with the mobile services switching centre MSC of the MSC
35 area in question.

The solution of Fig. 1, which is typical of the invention, illustrates two MSC areas, one of which includes a mobile services switching centre MSC1 and a visitor location register VLR1, while the other includes
5 a mobile services switching centre MSC2 and a visitor location register VLR2. Each MSC area divides into one or more location areas, and in each location area traffic is controlled by a base station controller BSC, which controls several base transceiver stations BTS.
10 Each cell mentioned above comprises one BTS, and one BSC serves several cells. A mobile station MS in a cell has a bidirectional radio link with the BTS of the cell in question. Between the BSC and the MSC there are both a signalling connection and voice channels.

15 In Fig. 1, the MSC1 controls the base station controller BSC1, which in turn controls the base transceiver stations BTS1 and BTS2. Correspondingly, in another MSC area the MSC2 controls a location area which contains the BSC2 and the BTS3 and BTS4.

20 A GSM network is usually connected to other networks, such as a Public Switched Telephone Network (PSTN), a Public Land Mobile Network (PLMN), a Packet Switched Public Data Network (PSPDN) or an Integrated Services Digital Network (ISDN), via a defined MSC
25 called a gateway MSC (GMSC). One or more (all) of the MSCs of the network may operate as the GMSC. It is possible to connect a voice channel from the GMSC to any other MSC of the network. The GMSC also has a signalling connection with the HLR. The HLR in turn has a signalling
30 connection with VLRs. Alternatively, a switching centre of another communication system, e.g. an ISDN centre, may operate as the GMSC.

35 Fig. 1 further describes a B-subscriber mobile station BMS to which an A-subscriber AMS is attempting to send a short message.

Fig. 2 shows the transmitting parts of a mobile services switching centre GMSC of the invention that is capable of independently transmitting short messages. An A-subscriber AMS of the network sends a short message, which has a structure as shown in detail in Fig. 3, to the GMSC. This short message is defined in GSM 04.11, point 7.3.1. The short message comprises an RP message type indicator field (MT), an RP priority indicator field (PI), an RP message reference field (MR), an RP originator address field (OA), an RP destination address field (DA), which in the prior art solution contained the SC address described in GSM 04.11, point 8.2.5.2. In the present solution, the DA of the RP-DA field is the address of the B-subscriber, by which the message is routed to the B-subscriber. The short message also comprises an RP-user data field (DATA). Fig. 2 further shows a means 1 in an MSC for transmitting a short message from a mobile phone, the means being described in GSM 03.40, paragraph 9. In the prior art solution the means reads the address of the SC from the RP-DA field of the short message and transmits the short message to the SC for forwarding. In the solution of the invention, the A-subscriber AMS sets the address of the B-subscriber in the RP-DA field, and the means 1 for transmitting a short message originated in an MS reads it and sends the short message to an address processing means 2, which reads the DA of the RP-DA field to detect where the short message is to be transmitted. If the RP-DA field contains the address of the SC, the short message is sent there; and if the RP-DA field contains the address of the B-subscriber, the short message is sent to a means 3 for controlling transmission of short messages, for further transmission to the B-subscriber BMS. Possible connection of an SC to a cellular radio network is described in GSM 03.40,

Appendix 1, ETSI. The means 3 for controlling transmission of short messages instructs a means 4 communicating with the HLR, the standard functions of this communicating means being described in GSM 09.02, point 5.13.1.2.1., to request the routing information of the B-subscriber BMS from the HLR of the B-subscriber by means of a send routing information for short message service routine. If the HLR contains the information on the location of the B-subscriber, the routing information is transmitted to the communicating means 4, which forwards them to the means 3 for controlling transmission of short messages. The controlling means 3 instructs a short message transmitting means 6 to send the short message, in the manner described in GSM 09.02, point 5.13.2.2.1, to the VMSC the MSC area of which the B-subscriber is visiting and into which VMSC the VLR is typically integrated. If the B-subscriber cannot be reached, the HLR announces this to the means 4 communicating with the HLR. The communicating means forwards the information to the means 3 for controlling transmission of short messages, which instructs a storing means 5 in an MSC to store the short message until the B-subscriber can again be reached and the short message can be transmitted to it.

In the prior art solution, if the B-subscriber cannot be reached, a message waiting data list according to GSM 03.40 is formed to the HLR. In the list are stored, B-subscriber-specifically, the addresses of the short message service centres SC in which short messages are stored for transmission to the B-subscriber. In the solution of the invention the list of waiting messages has been modified to contain the address of the GMSC (GMSC addr) in which the short messages sent to the B-subscriber are stored, and the international mobile subscriber number (IMSI1, IMSI2) of the A-subscriber.

Fig. 4 shows the message waiting data list according to the invention in the HLR. As the B-subscriber re-registers in the area of the VMSC, the VLR of the VMSC sends a message to the HLR of the B-subscriber stating that the B-subscriber can again be reached. After receiving this message, the HLR sends an alert to the GMSC of the A-subscriber stating that the B-subscriber is again reachable. In the solution on the invention, the HLR adds the IMSI of the A-subscriber and the mobile station international PSTN/ISDN number (MSISDN) of the B-subscriber from its message waiting data list to the alert so that the GMSC can identify the subscriber that has become within reach and the subscriber that has called. Having received the alert, the means 4 communicating with the HLR of the GMSC forwards the alert to the means 3 for controlling transmission of short messages. The controlling means initiates transmission of the short message to the B-subscriber via the VMSC of the location area of the B-subscriber.

The drawings and the description thereof are to be understood only as illustrating the idea of the invention. The method and arrangement of the invention for processing short messages in a cellular radio network may vary in details within the scope of the claims. Although the invention is described above mainly in the GSM, the method and arrangement for processing short messages in a cellular radio network can also be used in other kinds of radio systems.

Claims

1. A method for processing short messages in a mobile services switching centre (GMSC) of a cellular network, characterised in that an A-subscriber (AMS) sends a short message provided with the routing address of a B-subscriber (BMS), and the routing address contained in the short message is checked in the mobile services switching centre (GMSC), and when the routing address is that of the B-subscriber (BMS),
- the mobile services switching centre (GMSC) requests the routing information of the B-subscriber (BMS) from the home location register (HLR);
 - if the B-subscriber can be reached, the home location register (HLR) sends the routing information to the requesting mobile services switching centre (GMSC);
 - the mobile services switching centre (GMSC) routes the short message to the B-subscriber (BMS) on the basis of the routing information received.
2. The method of claim 1, characterised in that the short message is stored A-subscriber-specifically in the short message storing means (5) of the mobile services switching centre (GMSC) before the routing information request is made.
3. A method of claim 1, characterised by the following steps:
- the home location register (HLR) announces that the B-subscriber (BMS) is not reachable;
 - the short message is stored in the mobile services switching centre;
 - the home location register (HLR) announces that the B-subscriber (BMS) is reachable;

- the short message stored is transmitted from the mobile services switching centre (GMSC) to the B-subscriber;

5 - after receiving the short message, the B-subscriber sends an acknowledgement via the mobile services switching centre (GMSC) to the A-subscriber.

4. The method of claim 3, characterised in that

10 - the acknowledgement sent by the mobile services switching centre (VMSC) visited by the B-subscriber is negative if the transmission of the short message to the B-subscriber (BMS) has not succeeded; and

15 - the acknowledgement by the B-subscriber (BMS) is positive if the transmission of the short message to the B-subscriber has succeeded.

20 5. The method of claim 3, characterised in that the short message is stored in the mobile services switching centre (VMSC) of the mobile services switching centre area visited by the B-subscriber if the transmission of the message has been inhibited because of transmission of another short message.

25 6. An arrangement for processing short messages in a mobile services switching centre (GMSC) of a cellular network, characterised by comprising

- an address processing means (2) for checking the address contained in the short message;

30 - a storing means (5) for storing the short message in a mobile services switching centre (GMSC);

- a communicating means (4) communicating with a home location register (HLR) and requesting routing information from the home location register (HLR);

- a short message transmitting means (6) for transmitting short messages from the mobile services switching centre (GMSC) to a B-subscriber (BMS);

5 - a means (3) for controlling transmission of short messages to instruct the storing means (5) to store short messages, to instruct the communicating means (4) to request the routing information of the B-subscriber from the home location register (HLR), to forward the routing information of the B-subscriber
10 received from the home location register (HLR) from the communicating means (4), and to transmit the short message from the storing means (5) to the short message transmitting means (6) in response to the short message sent by the A-subscriber and provided with the address
15 of the B-subscriber, and to send an acknowledgement to the A-subscriber.

7. The arrangement of claim 6, c h a r a c -
t e r i s e d by comprising

20 an address processing means (2) operating in response to the short message sent by the A-subscriber, the short message containing the address of the short message service centre (SC), for transmission of the short message to the short message service centre (SC).

25 8. The arrangement of claim 6, c h a r a c - t e r i s e d in that the routing information request made to the home location register (HLR) contains the routing address of the A-subscriber, and that the home location register (HLR) comprises a subscriber-specific list (Fig. 4) that contains the address of the mobile
30 services switching centre (GMSC) processing the short message, and the address of the A-subscriber (AMS).

9. The arrangement of claim 6, c h a r a c -
t e r i s e d in that

35 in response to the information received from the home location register (HLR) stating that the B-

subscriber cannot be reached, the communicating means (4) communicating with the home location register (HLR) makes a similar announcement to the means (3) for controlling transmission of short messages, which
5 instructs the storing means (5) to store the short message.

10. The arrangement of claim 6, c h a r a c -
t e r i s e d in that
in response to the information received from
10 the home location register (HLR) stating that the B-subscriber can be reached, the communicating means (4) communicating with the home location register (HLR) makes a corresponding announcement to the means (3) for controlling transmission of short messages, which
15 instructs the short message transmitting means (6) to transmit the short message to the B-subscriber (BMS).

11. The arrangement of claim 6, c h a r a c -
t e r i s e d in that the storing means (5) in the mobile services switching centre (GMSC) stores the short
20 messages A-subscriber-specifically.

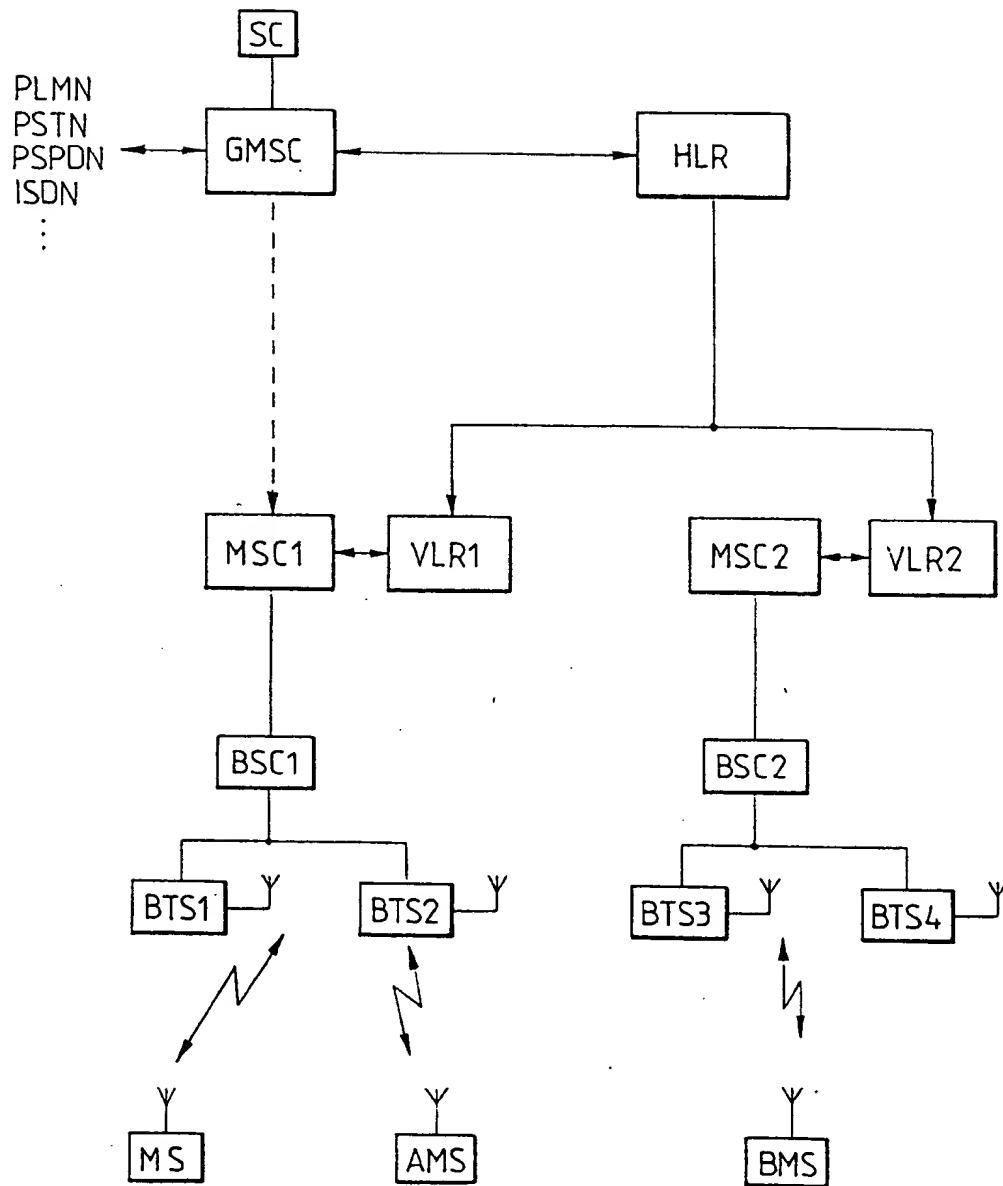


FIG. 1

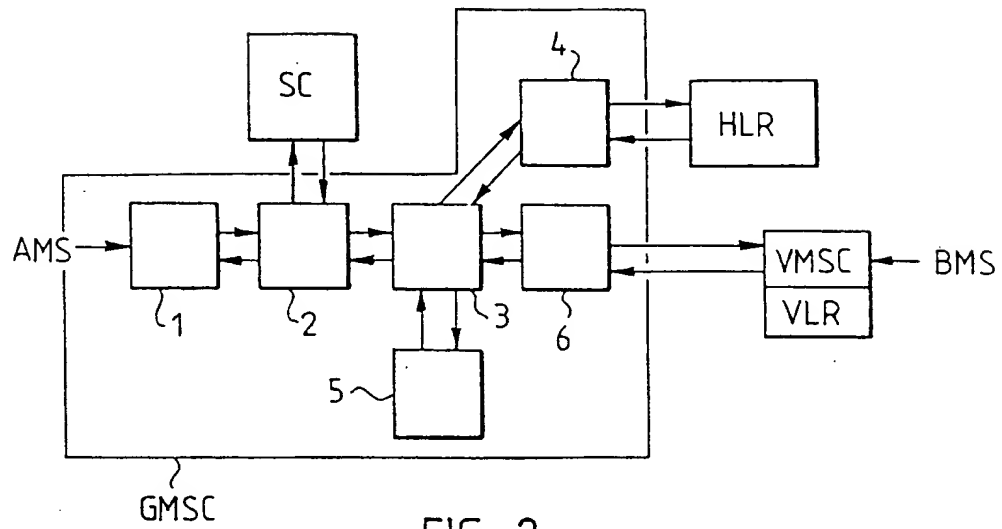


FIG. 2

MT	PI	MR	OA	DA	DATA
----	----	----	----	----	------

FIG. 3

GMSC Addr	IMSI1
GMSC Addr	IMSI2

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 93/00235

A. CLASSIFICATION OF SUBJECT MATTER		
IPC5: H04Q 7/04 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC5: H04B, H04Q		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
DIALOG: INSPEC, COMPENDIX, WPI, WPIL; ORBIT: WPAT, USPM		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Recommendation GSM 03.40, "Technical Realization of the Short Message Service - Point-to-Point", version 3.5.0, European Telecommunications Standards Institute, ETSI/PT 12, February 1992; see especially the paragraphs 3.1 (pages 10-11), 3.2.6 (pp.13-14), 3.2.8 (p. 15), 4.1 (pp.18-19), 5.2 (p. 20), 6-8 (pp. 20-25) and 10 (pp. 53-74). --	1-11
A	Recommendation GSM 09.02, "Mobile Application Part Specification", version 3.8.0, European Telecommunications Standards Institute, ETSI, January 1991; see pages 324-367 --	1,6
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
24 Sept 1993		27 -09- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Magnus Stiebe Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 93/00235

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>IEE Colloquium on "GSM and PCN Enhanced Mobile Services", IEE, London, UK, 1991 (Conference date 30 Jan. 1991); see pages 7/1-7/5</p> <p style="text-align: center;">-- -----</p>	1,6

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.